# IST Programme

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# MobiHealth

# End User Manual

| | |
|---|---|
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# 1 – GENERAL INFORMATION

## 1.1 Components described in this manual

This manual describes the following parts of the MobiHealth system:

1. The BAN (Body Area Network)
   The BAN is the part that is worn by the patient (or used by the nurse) to perform the actual measurements.

2. The PortiLab PC application
   This is the application running on the PC at the hospital that enables the doctor to view the received medical data.

## 1.2 Users addressed in this manual

This manual should be used by both patients and medical persons (doctors and nurses) who are involved in the MobiHealth trials.

Depending on your role in the trial your focus should be on a different part of the manual

| **Role** | **Work Description** | **Interested parts of this manual** |
|---|---|---|
| Doctor | View medical data at the hospital using the PortiLab viewer | Chapter 3: PortiLab manual. |
| Nurse | Use the BAN to visit patient and performs tests | Chapter 2: BAN manual.<br>Chapter 4: Getting your MobiHealth BAN started |
| Patient | Wear / use the BAN during the trial | Chapter 2: BAN manual.<br>Chapter 4: Getting your MobiHealth BAN started |

## 1.3 Trial specific information

In part 2-3-2 (MobiHealth PDA software) the trial-specific Manual Input on the PDA is discussed.

# 2 - BAN MANUAL

This part of the manual deals with the BAN (Body Area Network) part of the MobiHealth system. This is the part that is either worn by the patient or used by the nurse. It collects all data using the sensors and transmits these to the MobiHealth server using the MBU (Mobile Bas Unit)

## 2-1 Description of the BAN

A short description of the BAN is given here, to have an overview of the functions of each component.

As shown in figure 2.1, the BAN consists of the following components:

1 The MBU
The MBU (also called “PDA” or “iPAQ”) is the device that receives data from the SensorBox, stores them temporarily and sends them to the hospital. The MBU hardware is described in 2-2, the software in 2-3.

2 The SensorBox
The SensorBox (also called “Mobi” or “FrontEnd”) is connected by wire to all sensors and sends the sensor data (via Bluetooth) to the MBU. The SensorBox is described in 2-4

3 The Sensors
The sensors are connected to the human body and collect all the data. The number and type of sensors used are different per trial. The sensors are *not* described in this manual.

Figure 2.1: components of the BAN

## 2-2 The MBU hardware

This part of the manual describes the hardware part of the MBU. The software part (the applications running on the MBU) is described in 2-3.

The MBU hardware is divided into two parts:

- PDA
  This is the actual device that is used for the manual data input and to store the data.

- GPRS Jacket
  The GPRS jacket is the part that does the actual sending of the data to the MobiHealth server.

Figure 2.2: PDA

Figure 2.3: GPRS jacket

Both the PDA and the GPRS jacket have their own battery, which should be charged at regular intervals. Charging of the batteries is discussed in 2-2-3.

## 2-2-1 What's in the (PDA) box

Figure 2.4 shows all the items that are included in the (PDA) box.

❶ Extra stylus
❷ iPAQ Pocket PC H3800 series
❹ Universal cradle for both USB and serial connections with tether
❺ AC adapter
❻ DC adapter plug

Figure 2.4: What's in the box

## 2-2-2 Getting to know the PDA

### FRONT PANEL

Figure 2.5 shows all the most important parts of the front panel of the PDA

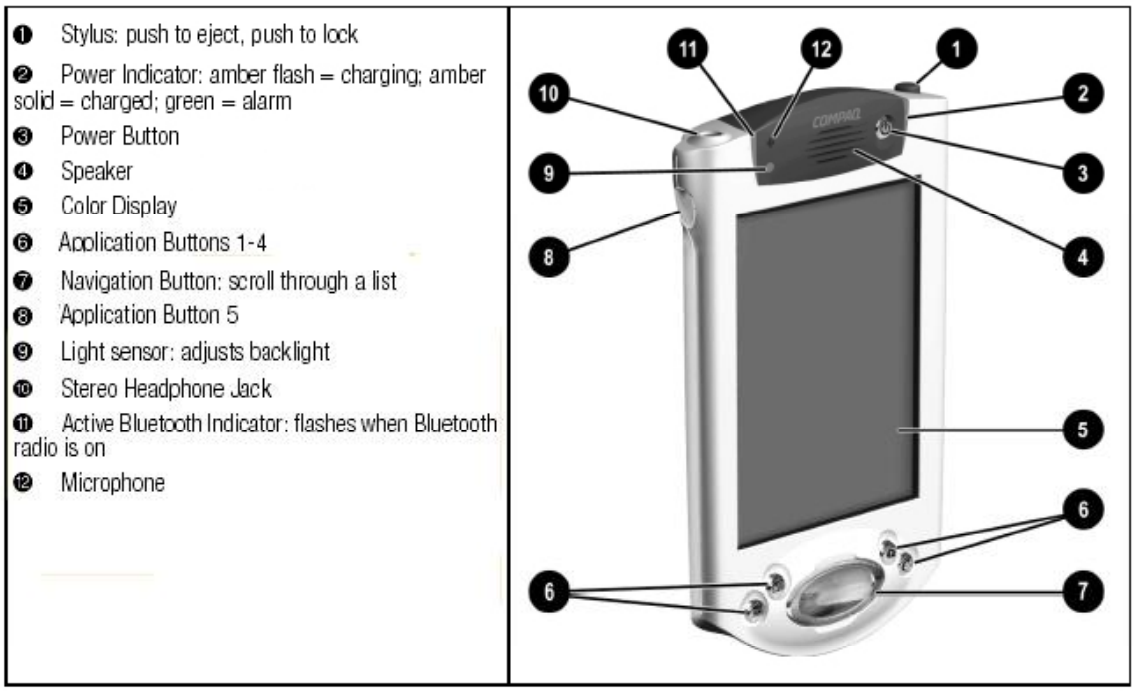



Figure 2.5: Front panel of the PDA

The display (5)

The PDA has a color touch display, which can be controlled using either the stylus (1) or your finger.

The pen (stylus) (1)

The pen (also called stylus) is located at the right top of the PDA. It can be removed by pressing it. To make sure not to loose the pen, always insert it into the PDA when not using it.

The buttons

*Power button (3)*
The power button must be pressed to switch the PDA on and off.

*NOTE: If pressing the power button does not have any affect when trying to switch the PDA off, an alternative method is selecting '**suspend'** via the start menu.*

*Scroll button (7)*
Use the scroll button to scroll to lists

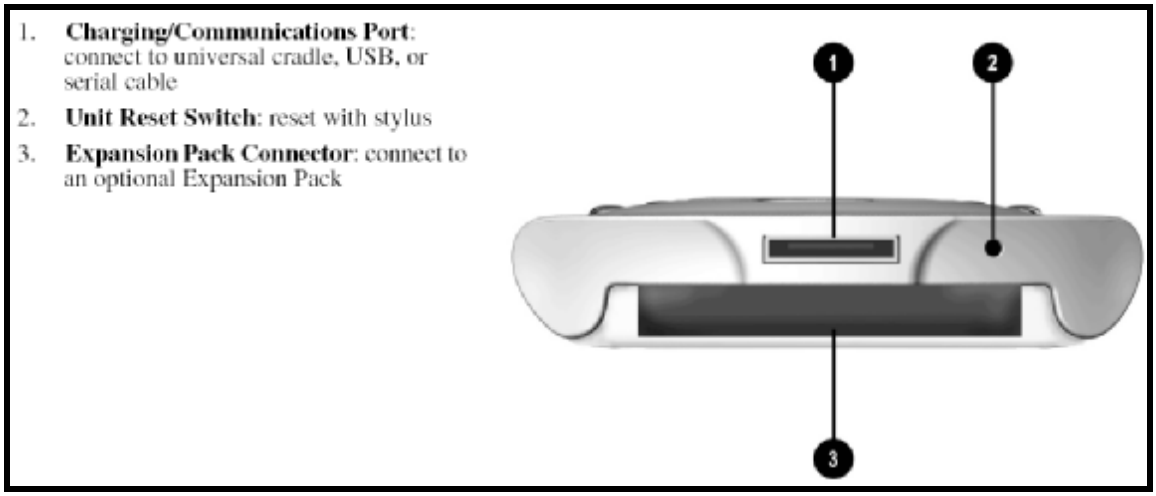
Indicator lights

*Bluetooth indicator (9)*
The blue light at the left of the PDA is the Bluetooth indicator. This light should always be blinking.

*Power indicator (2)*
The amber power indicator indicates if the battery is being charged (blinking) or fully charged (non-blinking)

BOTTOM PANEL

Figure 2.6 the bottom panel of the PDA.


1. **Charging/Communications Port**: connect to universal cradle, USB, or serial cable
2. **Unit Reset Switch**: reset with stylus
3. **Expansion Pack Connector**: connect to an optional Expansion Pack
1
2
3
Figure 2.6 Bottom panel of the PDA

## 2-2-3 Getting to know the GPRS Jacket

The GPRS jacket is essential for the communication between the PDA and the hospital. Figure 2.7 shows the top view of the GPRS jacket, figure 2.8 shows the back view.

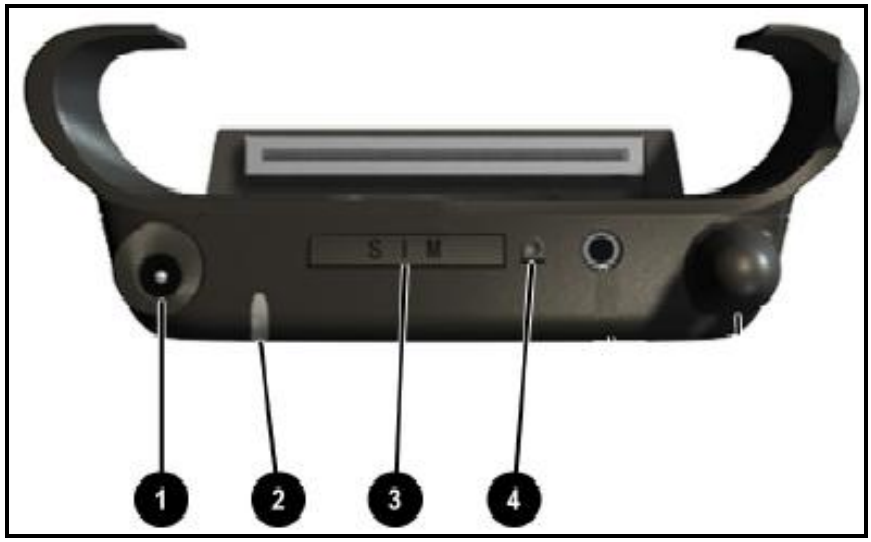



Figure 2.7: Top view of GPRS jacket

| | Component | Function |
|---|---|---|
| ❶ | DC Connector | Connects to a power source. |
| ❷ | Status LED | Provides status information for GSM/GPRS on your Wireless Pack. The color and blink state of the light indicate the following:<br>**Green/Blinking slow** = On and in service<br>**No light** = Off or battery depleted<br>**Red/Blinking slow** = Low battery voltage also shown in Wireless Pack display<br>**Red/solid** = Charging<br>**Green/solid** = Charged<br>**Green/Blinking fast** = Indicates SMS or Voicemail message is waiting<br>**Red/Blinking fast** = Shows unit is powered on but not registered on network. |
| ❸ | SIM Tray | Holds the SIM card. |
| ❹ | SIM Ejector Button | Ejects the SIM tray. |

Figure 2.8: Back view of GPRS jacket

| | Component | Function |
|---|---|---|
| ❼ | Power Button | Powers on your Wireless Pack and activates the signal. Your Wireless Pack stays on until you remove it from your Pocket PC or press the power button to power it off. |

## 2-2-4 Inserting the PDA into the GPRS jacket

Since the GPRS jacket does the actual data sending to the server, it is essential that **the PDA should always be inserted into the jacket during the trial**.

Figure 2.9 shows how to insert the PDA into the jacket; the result is show in figure 2.10.

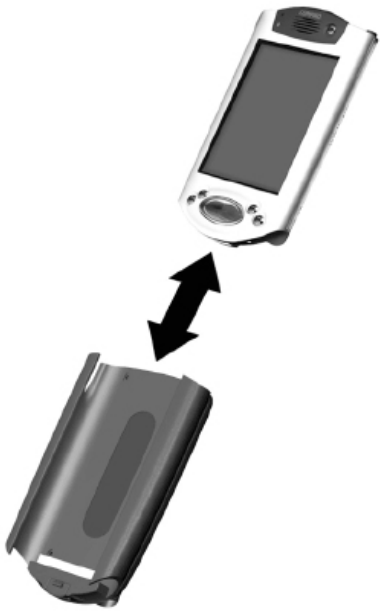


Figure 2.9: Inserting the PDA into the jacket

Figure 2.10: PDA inserted into the jacket

## 2-2-5 Charging the battery of the PDA & GPRS jacket

When using the PDA it is very important to **charge the battery at regular intervals**. When the battery of either the PDA or the jacket is running low, the data cannot be send to the hospital, meaning the trial cannot be performed correctly.

When the PDA is charged, the jacket is automatically charged with it (it is therefore sufficient if you charge only the PDA).

In order to keep the batteries full, it is recommended to charge the PDA when you are not using it.

Detecting if the battery is running low

The PDA will indicate if the battery is running low. Try to recharge it *as soon as possible* when this happens. If the GPRS jacket is running low on battery, this will be indicating by the slow blinking red LED on the jacket (if the LED does not turn on when the Jacket is turned on, it should also be charged).

There are two methods for charging the PDA battery:

1. use the cradle
2. use the AC adapter

## 1 Using the cradle to charge the PDA battery

To charge the PDA battery using the cradle, follow these steps:

1. Insert the AC power adapter (no. 5 in the box) into the back of the cradle (no 4 in the box) (figure 2.11)
2. Insert the AC power adapter into the AC outlet (figure 2.12)
3. Insert the PDA into the cradle (figure 2.13)

Figure 2.11: Step 1: Insert the AC adapter into the back of the cradle

Figure 2.12: Insert the adapter into the AC outlet

Figure 2.13: PDA inserted into the jacket

2 Using the AC adapter to charge the PDA battery

To charge the PDA battery using the AC adapter directly (without using the cradle), follow these steps:

1 Insert the DC adapter plug (no 6 in the box) into the bottom of the PDA (figure 2.14)
2 Insert the AC adapter power plug into the DC adapter plug (figure 2.15)
3 Insert the AC adapter into the AC outlet

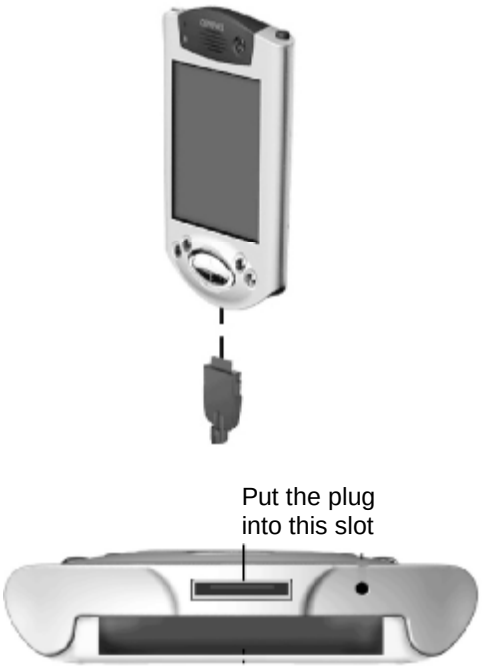



Figure 2.14: Insert the DC adapter plug into the bottom of the PDA

Figure 2.15: Insert the AC adapter into the DC adapter plug

Alternative charge method
Instead of inserting the DC adapter into the PDA, it is also possible to charge both the GPRS jacket and the PDA by inserting the DC adapter directly into the (top of) the GPRS jacket.
The charging-hole in the GPRS jacket showed with number (1) in figure 2.7 should be used to insert the DC adapter plug into.

*Note: use the ROUND connector of the DC adapter (the same as is used in figure 2.11 when charging via the cradle) to charge directly into the GPRS jacket.*

This charging method should be used if the method described above (inserting the DC adapter into the PDA) does not recharge the PDA.

When this charge-method is used, both the GPRS jacket and the PDA should indicate the charging (see next page).

Check if the battery is charging

PDA:
When the PDA battery is charging, the amber light (figure 2.16) is blinking.
The amber light is solid (non-blinking) during charging when the battery is fully charged.

GPRS jacket:
During charging the LED on top of the jacket (see figure 2.7 (2) ) is red, the LED turns green if the jacket is fully charged.

Figure 2.16: Battery status light

## 2-2-6 Resetting the PDA

In case the PDA does not respond (after approximately one minute) to user input anymore, a reset is needed. Resetting the PDA is done as follows:

- Insert the top of the stylus for 1 second into the small hole on the bottom of the PDA (see figure 2.6, (2))
- Remove the stylus, and wait until the regular screen has returned (be patient, this can take a few minutes).

After the PDA has been reset, a username and password has to be given. The default values here are:

**Username:** **root**
**Password:** **rootme**

However for some iPAQs (in particular the Swedish ones) individual user accounts have been created. Users will need to use their own username/password combination to login to the iPAQ.

*Note: Do NOT reset the PDA if you are not absolutely sure this will help.*

A complete step by step approach on how to get your MobiHealth MBU started can be found in chapter 4.

## 2-2-7 Routine care of the PDA

To keep the PDA in good condition and working properly, follow these guidelines:

- Keep the PDA away from excessive moisture and temperatures extremes. Do not expose your PDA to liquids.
- Do not place anything on top of your PDA to prevent damage to the screen.
- Clean the screen of the PDA by wiping the screen and the exterior with a soft, damp cloth moistened only with water.
- Avoid exposing the PDA to direct sunlight or strong ultraviolet light for extended periods of time. Also avoid scratching the surface of the screen and banging it against hard objects.
- Only use the PDA stylus to prevent scratching the screen.

## 2-3 The MBU software

During the trials two programs are being used on the PDA

- The MobiHealth software
  This is the main program on the PDA that has the following functions:
  - Receives the sensordata from the SensorBox
  - Handle manually inputted data.
  - Sends the data to the BackEnd system

- The data viewer
  This program can be used to view the data that is being measured directly on the PDA. This program should be used for check purposes only.

These programs are explained in this part of the manual. Both general issues as trial specific issues are handled here.

To be able to work correctly with the programs on the PDA, we will first discuss some general issues:
- 'Home' screen of the PDA
- Using the keyboard to do text input

### 2-3-1 General software issues

**Using the keyboard**
To be able to input data on the PDA, the build in 'virtual keyboard' must be used.
To show this keyboard, click on the keyboard icon in the left-bottom of the screen (see figure 2.17).

Figure 2.17: Showing the virtual keyboard

There are two input methods available:
1 – Handwriting (figure 2.18)
2 – Regular keyboard (MultiKey) (figure 2.19)
THIS IS THE RECOMMENDED INPUT METHOD

Choosing between these methods is done by clicking on the arrow next to the keyboard icon (see figure 2.17).

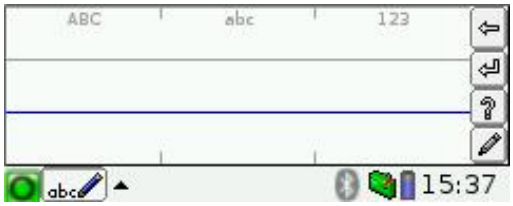



Figure 2.18: Handwriting input method

Figure 2.19: Keyboard (MultiKey) input method (RECCOMENDED)

## 2-3-2 MobiHealth software

**Start the MobiHealth software**
To start the MobiHealth software on the PDA, take the following steps:

- Select the MobiHealth tab (figure 2.20)
- Click the MobiHealth icon (figure 2.21)
- Wait until the screen as shown in figure 2.22 is shown
- Now activate the software by pressing the 'Start' button (see figure 2.22a) and wait until the text 'MBU Activated' is shown (figure 2.22b)
- Make sure to turn on the SensorBox (see part 2-4) within 3 minutes after starting the MobiHealth BAN software, so the MobiHealth software can connect to the SensorBox.
- If the MobiHealth software is connected to the SensorBox, the icon in the left part of the screen shown in figure 2.23 should appear.

Figure 2.20: The MobiHealth tab

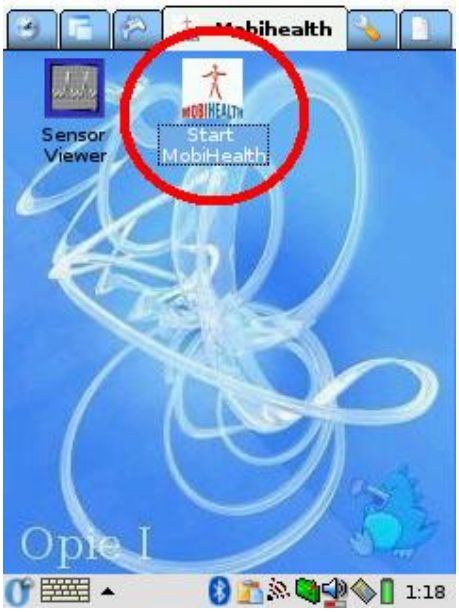


Figure 2.21: The MobiHealth Icon

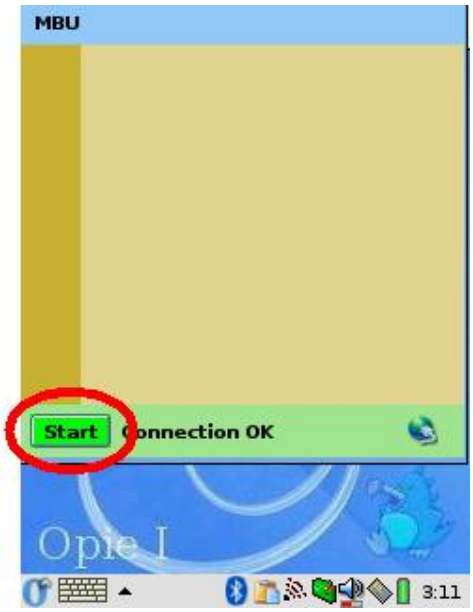



Figure 2.22a: Startup screen

Figure 2.22b: MBU is activated

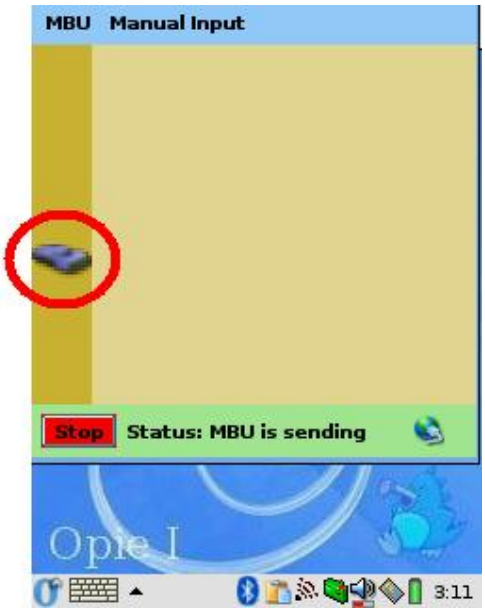



Figure 2.23: Icon indicating successful connection to the SensorBox.

## MANUAL INPUT PART

For each trial there is a separate part in the BAN MobiHealth software that enables manual input. The function of this manual input is to input non-sensor data into the MBU, and send this (together with the sensor data) to the MobiHealth server. The (medical) meaning of the manual input differs per trial, examples are:

- Patient temperature (measured with a traditional thermometer)
- Activity type
- Fluid type
- Pupil size
- Additional comments

For each trial there is a different 'manual input' section. This section is started by selecting the menu-item 'Manual Input' (figure 2.24) and then select the name of your trial.

Figure 2.24: Start the manual input

**Changing the language**

To change the program language, select the menu-time 'Language' and then select the language of your choice. After selecting another language, the MobiHealth application has to be restarted to use the new selected language.

### Input manual data

Before entering any data in the manual input fill in the patient information (figure 2.25). This screen can be started by selecting the menu-item 'Definitions' and then select 'id-information'. To turn back to the manual input click on the 'Change id info' button.

Figure 2.25: Patient information

Because the data that is inputted manually is different per trial, figure 2.26 to 2.35 show the manual input screen(s) for each trial.

Figure 2.26: LIGHTHOUSE trial

Figure 2.27: CARDIO trial

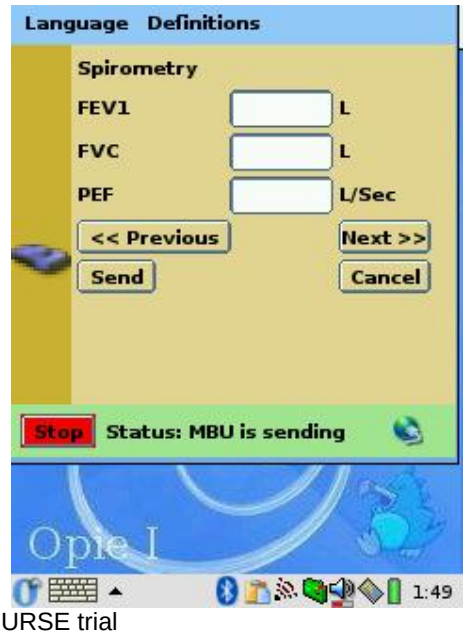



Figure 2.28a and b: NURSE trial

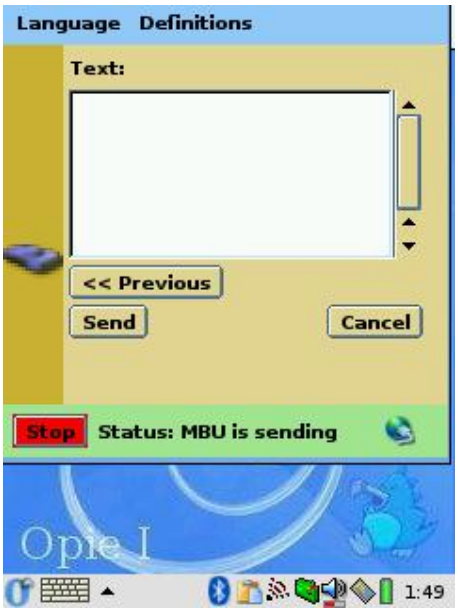



Figure 2.28c: NURSE trial

Figure 2.29: OUTDOOR trial

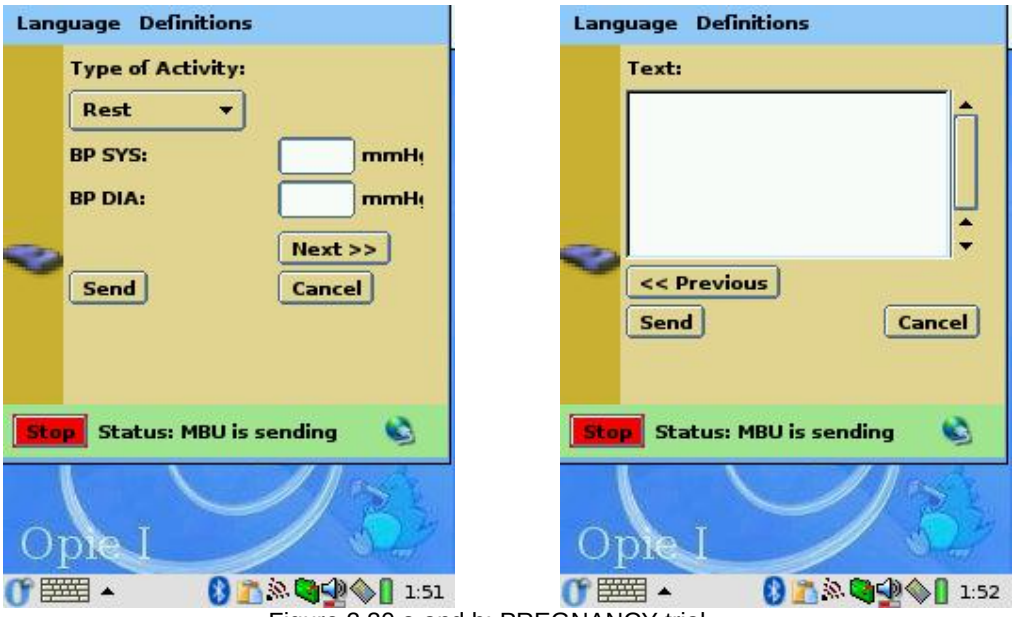



Figure 2.30 a and b: PREGNANCY trial

Figure 2.31 a and b: RA trial

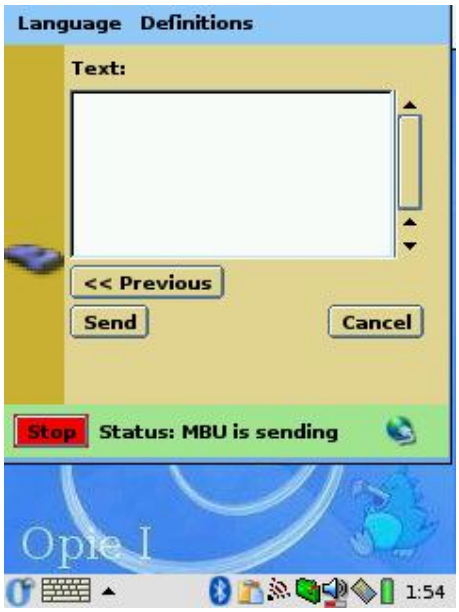



Figure 2.32 a and b: REMOTE trial

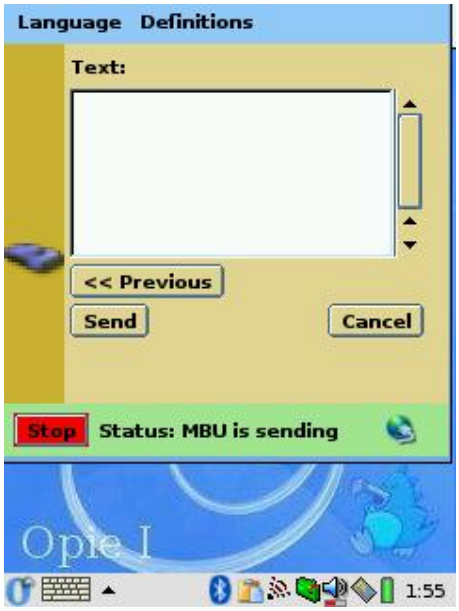



Figure 2.33 a and b: RESP trial

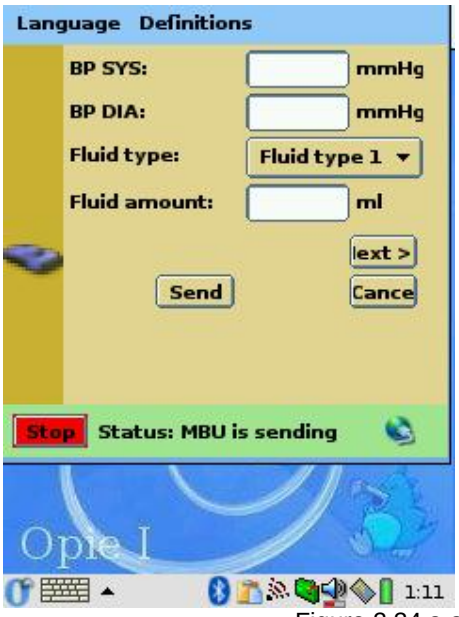


Figure 2.34 a and b: TRAUMA trial

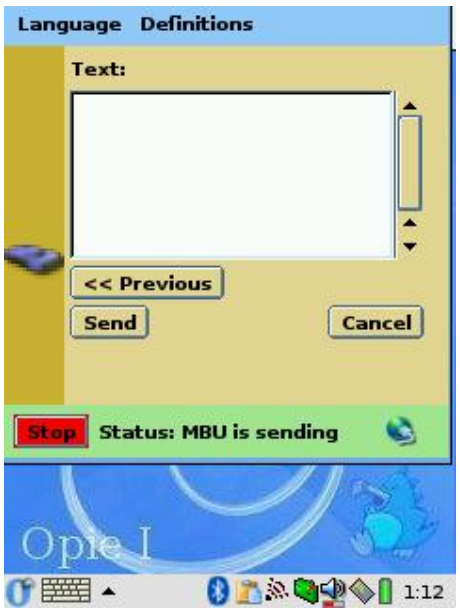



Figure 2.35 c: TRAUMA trial

General manual input issues:

- For text input (either numerical or alphanumerical) use the virtual keyboard (see 2-3-1)
- To select an item from a list (for example in the RA trial, figure 2.31), click on the arrow, the list with items is then shown. The scroll buttons right next to the list enable you to see all items in the list. Select the required item by clicking it.
- The cursor is not always visible. To check if the cursor is in the correct textbox, start typing on the virtual keyboard. If the cursor is in the correct textbox, the typed in text will appear here now.

**Send the manual inputted data**

After the manual data has been inputted, it must be send to the MobiHealth server. This is done by pressing one of the send-buttons. If the send-action was successful, then the manual input screen disappears, it can be shown again by selection the menu-item 'Manual Input' again.

**Cancel the manual input**

When the manual input is started by accident, or you want to quit the manual input, then you can use the 'cancel' button. This button can be found on each screen.
The screen will be hidden by pressing this button, *without* sending the data to the MobiHealth server (see figure 2.37).

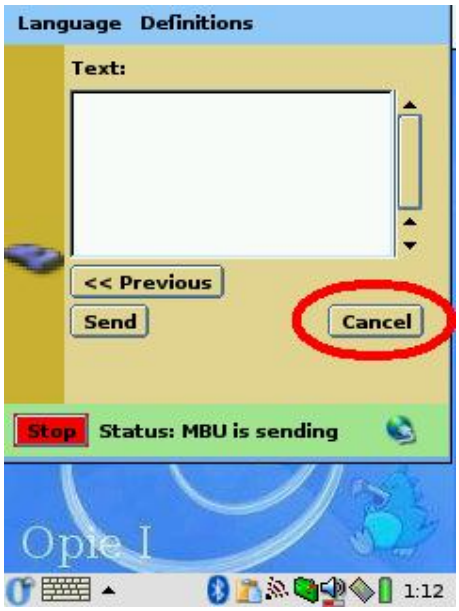



Figure 2.37: Cancel button

**Sanity check**

All the values in the screen will be checked if the send-button, previous button or next button is pressed. When some values are proved invalid an error message will be shown (see figure 2.36).

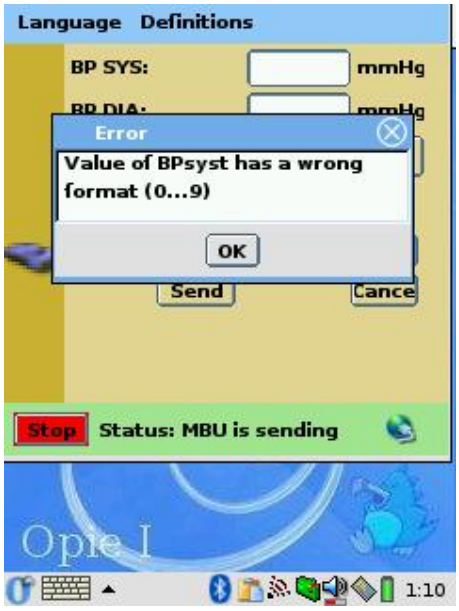



Figure 2.36: Error message

This check (the sanity check) that is performed, is different for every trial, because each trial has different input values. Table 2.37 shows per trial which values are checked and how.

| Trial | Name value | Required | Min-value | Max-value | Max-length |
|---|---|---|---|---|---|
| **Lighthouse** | Text | No | | | 100 |
| **Cardio** | BP Sys | No | 70 | 250 | |
| | BP Dia | No | 50 | 200 | |
| | Text | No | | | 100 |
| **Nurse** | BP Sys | No | 70 | 250 | |
| | BP Dia | No | 50 | 200 | |
| | Glucose | No | 2.0 | 40.0 | |
| | Temperature | No | 36.0 | 42.0 | |
| | FEV1 | No | 0.1 | 10.0 | |
| | FVC | No | 0.1 | 20.0 | |
| | PEF | No | 0.1 | 25.0 | |
| | Text | No | | | 100 |
| **Outdoor** | BP Sys | No | 70 | 250 | |
| | BP Dia | No | 50 | 200 | |
| | Text | No | | | 100 |
| **Pregnancy** | BP Sys | No | 70 | 250 | |
| | BP Dia | No | 50 | 200 | |
| | Text | No | | | 100 |
| **RA** | Step | No | 5 | 200 | |
| | Text | No | | | 100 |
| **Remote** | BP Sys | No | 70 | 250 | |
| | BP Dia | No | 50 | 200 | |
| | Glucose | No | 2.0 | 40.0 | |
| | CRP | No | 1 | 999 | |
| | Text | No | | | 100 |
| **Resp** | Step | No | 5 | 200 | |
| | FEV1 | No | 0.1 | 10.0 | |
| | FVC | No | 0.1 | 20.0 | |
| | PEF | No | 0.1 | 25.0 | |
| | Text | No | | | 100 |
| **Trauma** | BP Sys | No | 70 | 250 | |
| | BP Dia | No | 50 | 200 | |
| | Fluid amount | No | 0 | 250 | |
| | Text | No | | | 100 |
| **ID information** | ID | Yes | | | 11 |
| | First name | No | | | 15 |
| | Last name | No | | | 25 |
| | Text | No | | | 100 |

Table2.37: Checked values

**Stop the MobiHealth software**

When enough measurement data is send to the server then the MobiHealth software can be stopped. This can be done by pressing the stop button. All data that's not send yet, buffered data, will be send and the message displayed on the MBU will be 'Flushing data'. The MBU disconnects from the server when all the data is send.

**Note: You'll have to wait at least three minutes before restarting the MobiHealth software,**

## 2-3-3 SensorViewer

The sensor can be used to view the data that is being measured (by the Mobi) directly on the MBU. This program is useful for checking the connection with the Mobi.

To start the SensorViewer on the PDA, take the following steps:

- Select the MobiHealth tab (figure 2.38)
- Start the Mobi by pressing the on/off switch (figure 2.42)
- Click on the SensorViewer icon (figure 2.39)

*NOTE: It is recommended NOT to have both the 'Start MobiHealth' and the Senorviewer active on the MBU. Therefore it is better to exit the 'Start MobiHealth' application before starting the Sensorviewer application.*

Figure 2.38: MobiHealth tab

Figure 2.39: SensorViewer Icon

If the MBU is able to connect to the Mobi then a screen like figure 2.40 should appear.

For each sensor that is connected to the MBU a tab is shown at the top of the screen. By clicking on one of these tabs the data of this sensor will be shown.
Some actions can be performed to change the view:

- Speed
  The interval of drawing can be changed with the slider at the bottom of the screen. When the value this slider is 1, then every incoming data is shown. If this slider has value 4 then each forth incoming measurement is shown.
- Amplitude
  The amplitude of the view can be changed with the '+' and '-' buttons at the bottom of the screen.

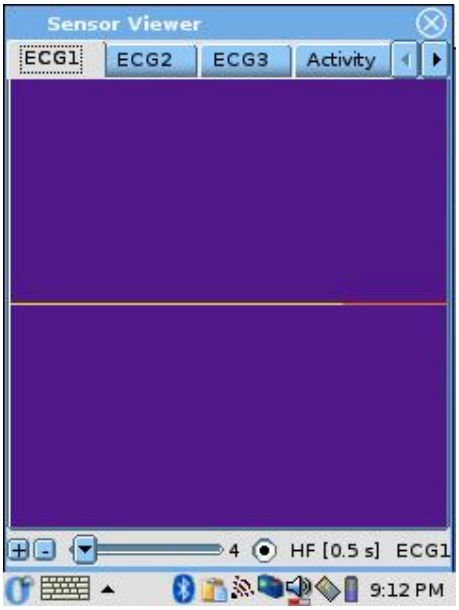


Figure 2.40: SensorViewer ECG view

Go to the SawTooth tab to check if the Mobi is really sending data and is connected correctly to the MBU. If a SawTooth is drawn (figure 2.41) the connection between the Mobi and the MBU is ok. The connection is lost when you see a flat-line. Restart the Mobi and the SensorViewer program to solve this problem.

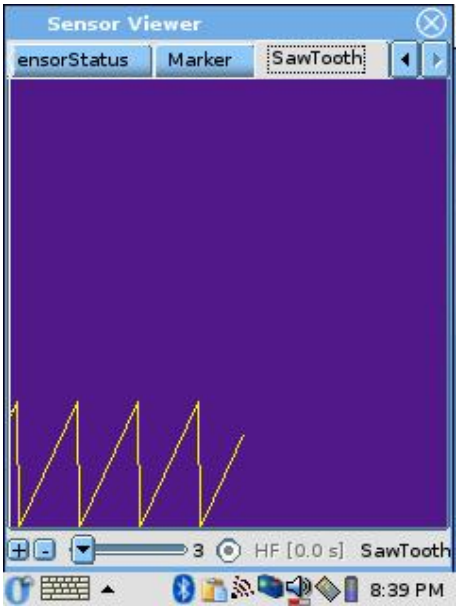


Figure 2.41: SawTooth view

## 2-4 The SensorBox

The SensorBox consists of a so called front-end and a set of sensors.

All trials can be covered with two types of front-ends: a 4-channel front-end (Mobi4) and a 9-channel frontend (Mobi9).

The Mobi4 can be configured to have either 4 inputs for ECG, or 3 inputs for ECG and 1 auxiliary input. Further optional parts are a marker/alarm button input, and a pulse-oximeter input. The auxiliary input can be used to connect either a respiration sensor or a movement/activity sensor.

The Mobi9 has 9 ECG inputs. These signals can be converted into a standard 12-lead ECG setup.
Both types are fitted into the same type of enclosure. For verification purposes it is possible to store the measured signals locally on a MultiMediaCard (MMC). Each mobi comes with a carrying bag for easy ambulatory use.

Figure 2.40: Top view (Sensor connectors)

<TO BE ADDED>

Figure 2.41: Bottom view (SpO2-connector)

Figure 2.42: Front view (Power button)

Figure 2.43: Back view

Figure 2.44: Front view with open battery cover

Figure 2.45: Attached sensors

Sensors that can be connected to the Mobi:

- ECG electrode leads (for 2-lead, 3-lead or 12-lead ECG)
- respiration sensor
- activity/movement/position sensor
- pulse-oximeter (gives saturation value, plethysmographic waveform and heart rate)
- marker/alarm button

By means of hardware variations and embedded software definitions, the systems can be tailored to the needs of the different trials.
In this way, 6 different variants are defined:

| Type | Base | nr of ECG | nr of AUX | pulse-oximeter | marker / alarm | Used in trails |
|---|---|---|---|---|---|---|
| 3e1am | mobi4 | 3 | 1 | no | yes | Lighthouse, cardio |
| 3e1as | mobi4 | 3 | 1 | yes | no | Resp, outdoor, trauma, nurse |
| 3e1a | mobi4 | 3 | 1 | no | no | RA |
| 4em | mobi4 | 4 | 0 | no | yes | Pregnancy |
| 4e | mobi4 | 4 | 0 | no | no | -- |
| 9e | mobi9 | 9 | 0 | no | no | discharge |

On the front of the Mobi are the connectors for the ECG leads, the respiration and activity sensor, and the marker/alarm button.
The front panel also has a status light (LED).
The back of the Mobi has a connector for the pulseoximeter sensor.
On top of the Mobi is the on/off button.
When the battery cover of the Mobi (on the backside) is removed you have access to the battery compartment and the slot for the MultiMediaCard (for ambulatory measurements).

**Connecting sensors**
*All different sensors have their own type of connector on the front panel of the Mobi. It is virtually impossible to make mistakes with this.*
*Please note that for ECG measurement, you will always need to connect also the Patient Ground lead ('GND').*
The connection for the pulseometer is on the backside (4-pin metal connector). Connect the pulseoximeter module first and then connect the finger sensor to the module.

**Status light**
*The light (LED) in the front panel indicates the status of the Mobi:*

- During power up: orange, followed by solid green.
- Solid green: powered and ready.
- Blinking green: powered and recording on MultiMediaCard (MMC).
- Blinking orange: batteries are running low, or (after trying to start an ambulatory recording on the MMC) recording error.
- Solid orange: batteries are empty, Mobi will finish all actions and shut down within a few seconds.

**On/off button**
The button on top of the Mobi has two functions: power on/off and alarm button (alarm trail only).
When the Mobi is off, it can be powered on by shortly pressing the on/off button. The status light gives an indication. It can be shut down by again pressing the on/off button shortly. The status light will go out.
*For the alarm trail only: when the Mobi is powered on, an alarm is triggered when the on/off button is pressed. The status light will start blinking either green or orange when an alarm is triggered.*

**Replacing the batteries**
It is recommended that for each use a fresh set of batteries is used. 2 AA-type cells are required, either rechargeable (NiMH, 1.2V) or non-rechargeable (Alkaline, 1.5V). Please note that rechargeable cells have a considerably shorter lifetime.

Open the battery cover, by squeezing it slightly on the bottom side at the mark, and sliding it backwards. Please make sure that the polarity of the batteries is right. This is indicated by the figure on the inside of the battery compartment. Close the cover. Make sure that it is tightly shut. If the battery cover is not closed correctly, the Mobi cannot be started. Also note that when the Mobi is active while the battery cover is opened, it shuts down immediately. This is a safety precaution.

Battery tips:
- When using the Mobi to measure continuously, replace the batteries daily.
- When the Mobi is not used for a long period, remove the batteries.

## 2-5 The sensors

This paragraph gives a short description of the different type of sensor used in the MobiHealth trials.

**Pulse-oximeter:**
Measures saturation value (SaO2), plethysmographic waveform, heart rate and sensor status.
The sensor is to be applied to the finger, and measures the signal by means of red and infrared light.

**Activity:**
This sensor measures acceleration in 1 direction. It can be used to detect activity (high frequency part of the signal) and 1D position (standing up, lying down, DC/low frequency part of the signal). It should be positioned in such a way that the 'top' of the sensor points to the head of the subject/patient.

**Respiration:**
This sensor measures respiration by detecting changes in the circumference of a belt around the thorax or abdominal region.

**ECG:**
ECG is measured by placing pre-gelled AgCl surface electrodes (single use) at predefined places, and connecting these electrodes to the Mobi amplifier with shielded electrode leads. These leads have a snap connector, so that they fit onto a large number of standard available ECG electrodes.

# 3 - PORTILAB MANUAL

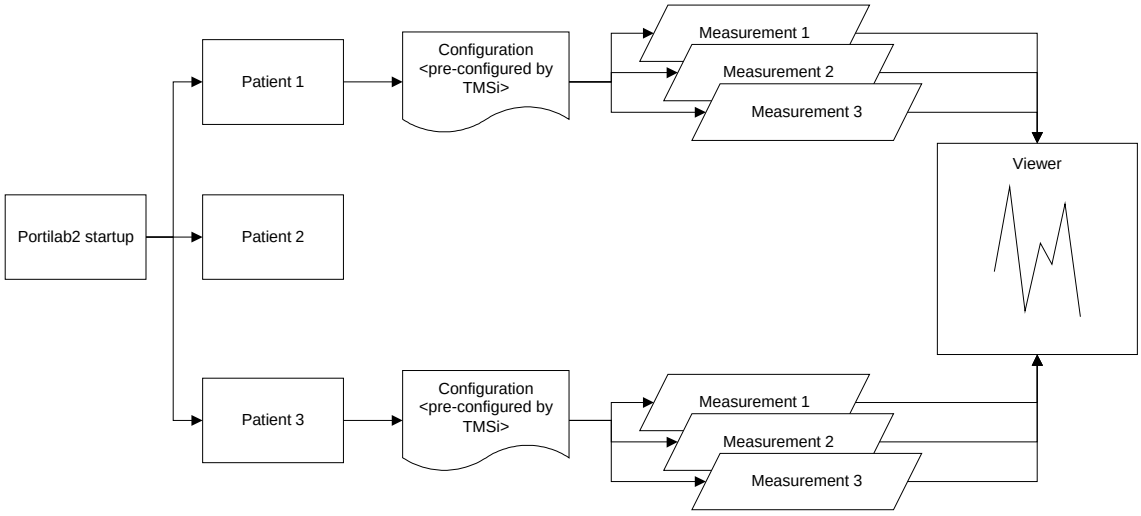
## 3-1 General information

The PortiLab PC application is the part of the MobiHealth system that is being used to view the received (medical) data at the hospital. PortiLab must be used by the medical persons who want to view the collected patient sensor-data. PortiLab should therefore be installed on a PC in the hospital (which has access to the Internet to be able to receive the sensor-data).

PortiLab uses the following components:

- Configuration
  This is the trial specific configuration file that is created by TMSi.
- Patient
  Each patient is created in PortiLab and has its own measurement
- Measurement
  Each measurement creates an output for the viewer.

The figure below shows the overview of these components.




The steps to take in order to view the sensor-data for a patient are:

1. Startup the PortiLab application
2. Select the ‘Patient Management’ option
3. Select an existing patient or create a new patient
4. Select an existing measurement or create a new measurement
5. View the signals in the viewer.

All steps are explained in detail in the following paragraphs.

## 3-2 Working with PortiLab2: The patient data manager

After PortiLab2 is started you will have two main modules:

- **Patient management**
  This part is used to perform standard routine measurements on patients.
  This is the only part that is used within the MobiHealth trials.

- **Configuration management**
  This part is used to develop the measurement configurations that are used in the Patient data measurement part
  **This part should NOT be used during the MobiHealth trials, PortiLab will be pre-configured by TMSi.**

Figure 3.1: the starting screen of PortiLab2

After starting the Patient manager you will enter the patient database. This database shows you a list of patients, as shown in figure 3.2. This list contains the following fields:

- First name
- Last name
- Date of Birth
- Comment

Figure 3.2: the patient list

Using your mouse or the arrow keys you can step through the list and you can highlight the patient records. Select a patients name by double-click or choose *open*.
Back will bring you back to the start window.

To add a new patient name select *add new patient*, the screen as is shown in figure 3.3 will be visible.

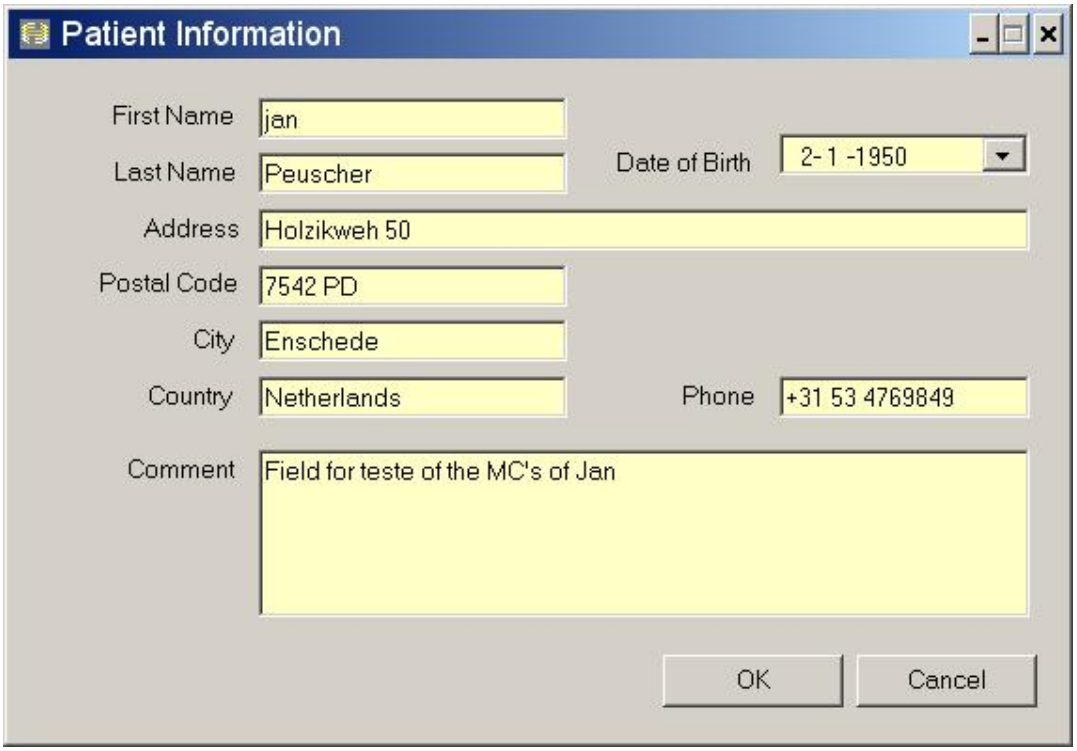



Figure 3.3: the patient information

This window is used to enter the most important items concerning the patient. A number of fields have to be filled in, otherwise the program will not continue. After having filled in the items you return to the database by pressing OK

When you do not select Add new patient, but select an existing name you will enter the database of measurements; that where performed on that patient; the measurement list. See figure 3.4.

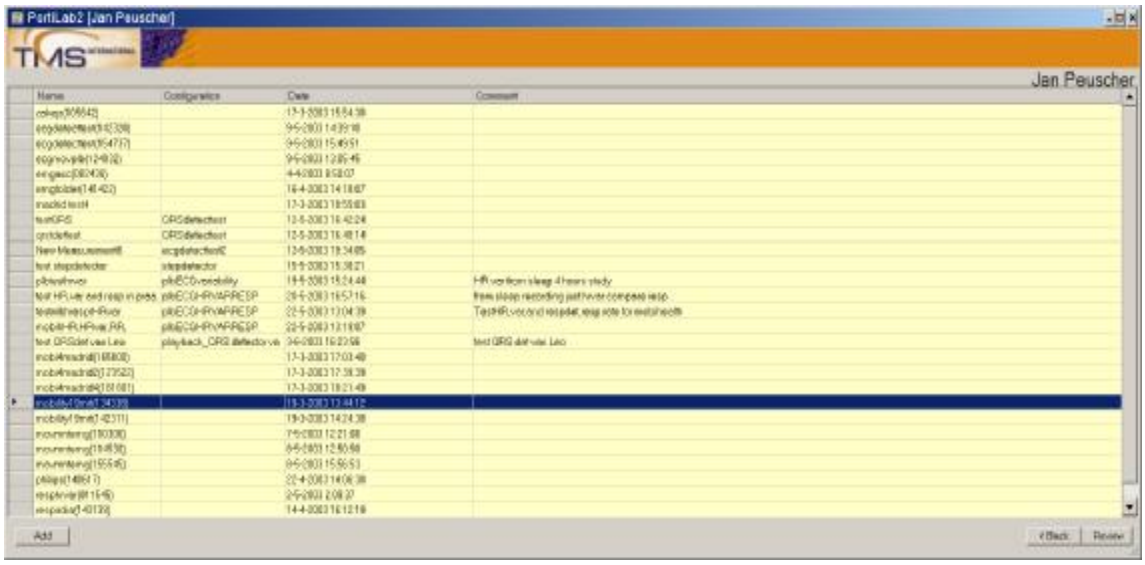



Figure 3.4: Measurement list of patient Jan Peuscher.

The measurement list shows the most important details of all previous saved measurements:

- Name
- Measurement Configuration
- Measurement Date
- Measurement Duration
- Type of Measurement
- Comments on this Measurement

After you have entered the measurement list of the chosen patient, two main choices are available:

- Perform a new measurement
- Select an existing measurement for review, editing or report

**Performing a new measurement on a patient.**
After having selected *Add New Measurement* a new measurement can be performed, and the measured date can be added to the measurement list of the selected patient.
Two types of measurements are available:

- Non-realtime measurements
- Realtime measurements

**MobiHealth non-realtime measurements.**
The measured data is send to the MobiHealth server were it is stored. Later on this data can be received on the PC and stored locally.

**Mobihealth realtime measurements.**
While sending measured data to the MobiHealth server the data is redirected to the PC where it can be viewed directly and stored if needed.

## 3.2.1: Non-realtime/realtime measurements

Measurements can be performed either realtime (the measurement data is shown in PortiLab at the same time while it is measured) or non-realtime (the measurement data has been stored on the backend server and is being shown in PortiLab at a later time).

An non-realtime or realtime measurement is performed as follows:

- First add the patient that is monitored to the database.

  *NOTE: In the comment part of the patient data it is recommended to input the BAN number that is used by the patient to connect to the back-end server. This is done to simplify the selection of the correct measurement later on in PortiLab. If the BAN number is entered, the format MUST be exactly as mentioned here (Example is show in figure 3.7)*

> *ATTENTION:*
> *The format used here to enter the BAN number is:*
> ***<MBU="xxxxxxxxxxx">***
> *where xxxxxxxxxx is the MBU name'.*

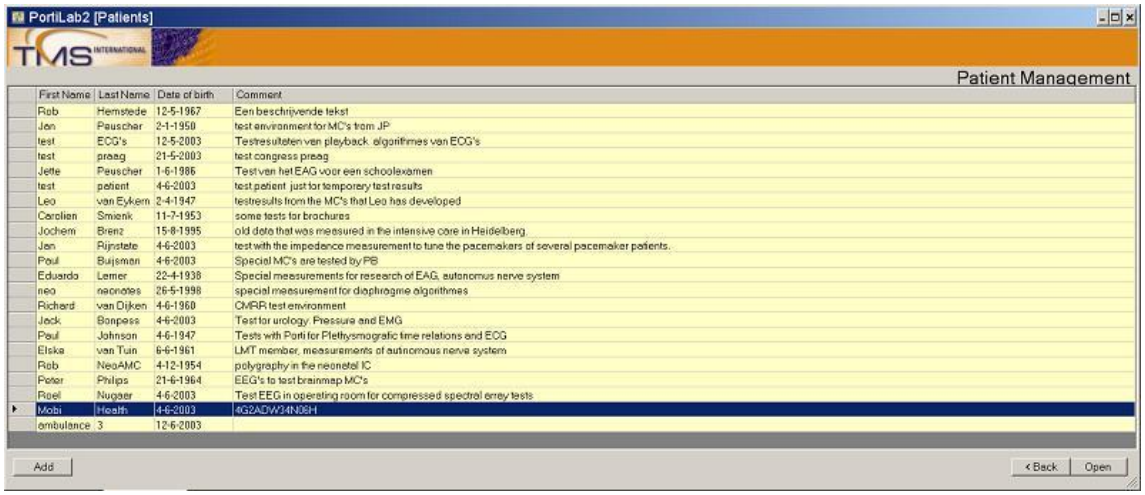

PortiLab2 [Patients]
Patient Management
First Name | Last Name | Date of birth | Comment
Rob | Hemstede | 12-5-1967 | Een beschrijvende tekst
Jan | Peuscher | 2-1-1950 | test environment for MC's from JP
test | ECG's | 12-5-2003 | Testresulteten van pleyback algorithmes van ECG's
test | praag | 21-5-2003 | test congress praag
Jette | Peuscher | 1-6-1986 | Test van het EAG voor een schoolexamen
test | patient | 4-6-2003 | test patient just for temporery test results
Leo | van Eykern | 2-4-1947 | testresults from the MC's that Leo has developed
Carolien | Smienk | 11-7-1953 | some tests for brochures
Jochem | Brenz | 15-8-1995 | old data that was measured in the intensive care in Heidelberg
Jan | Rijnstate | 4-6-2003 | test with the impedance measurement to tune the pacemakers of several pacemaker patients.
Paul | Buijsman | 4-6-2003 | Special MC's are tested by PB
Eduardo | Lemer | 22-4-1938 | Special measurements for research of EAG, autonomus nerve system
neo | neonates | 26-5-1998 | special measurement for diaphragme algorithmes
Richard | van Dijken | 4-6-1960 | CMRR test environment
Jack | Bonpess | 4-6-2003 | Test for urology: Pressure and EMG
Paul | Johnson | 4-6-1947 | Tests with Porti for Plethysmografic time relations and ECG
Elske | van Tuin | 6-6-1961 | LMT member, measurements of autinomous nerve system
Rob | NeoAMC | 4-12-1954 | polygraphy in the neonatal IC
Peter | Philips | 21-6-1964 | EEG's to test brainmap MC's
Roel | Nugger | 4-6-2003 | Test EEG in operating room for compressed spectral array tests
Mobi | Health | 4-6-2003 | 4G2ADW34N06H
ambulance | 3 | 12-6-2003
Add
< Back
Open

Figure 3.7: Patient called 'Mobi Health' wears BAN number '4G2ADW3406H'.

- In the patient database select 'add new measurement'. The screen in figure 3.8 is shown.

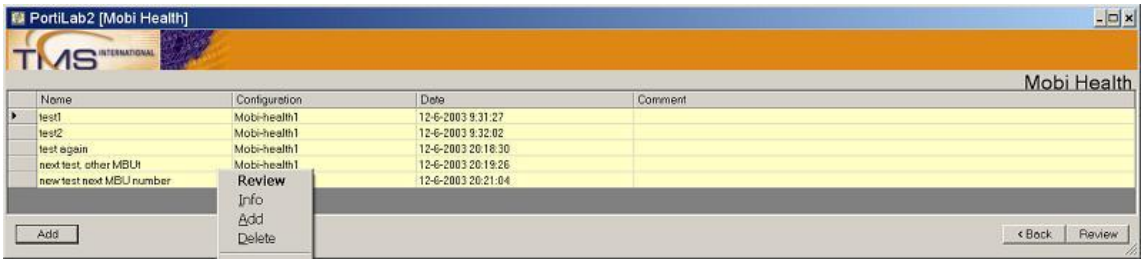



Figure 3.8: Overview of all performed measurements.

- The measurement configuration that is selected has been pre-configured with the BAN-type that is given in the user-comments part.
- To perform the measurement select the Measurement Configuration as shows in figure 3.9

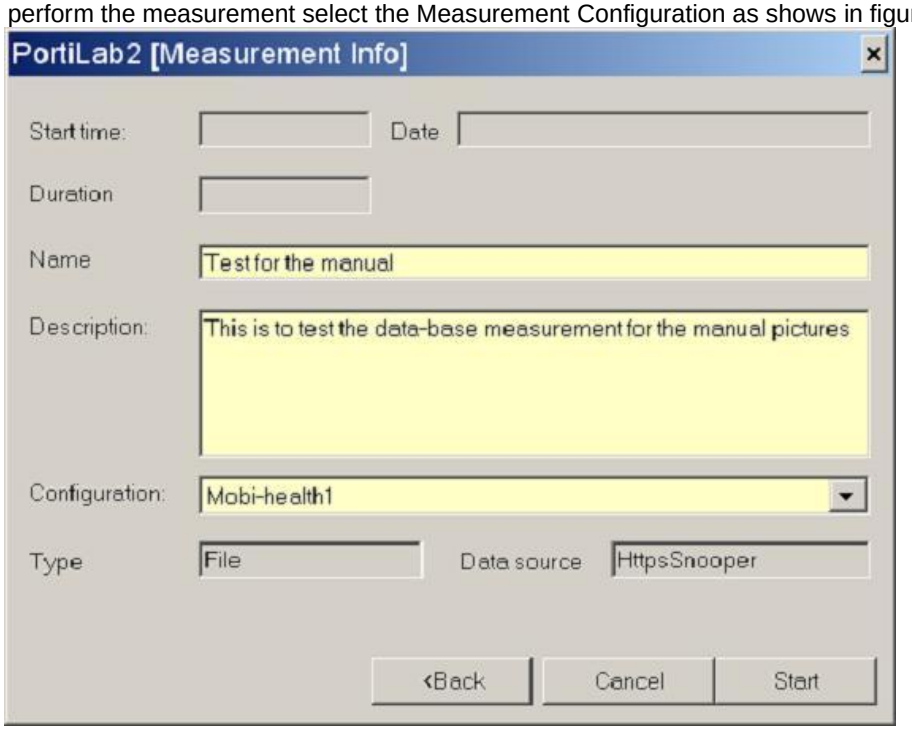



Figure 3.9: Measurement info screen.

- The MC will now contact the back-end server via the Internet. When contact has been established, the screen as show in figure 3.10 will be shown.
  The unique MBU number will automatically be selected, and the measurement can be started by pressing 'OK' in this screen. From this point, measurement signals will be received and displayed on the PortiLab screen. To save the data the 'Store' button must be selected.

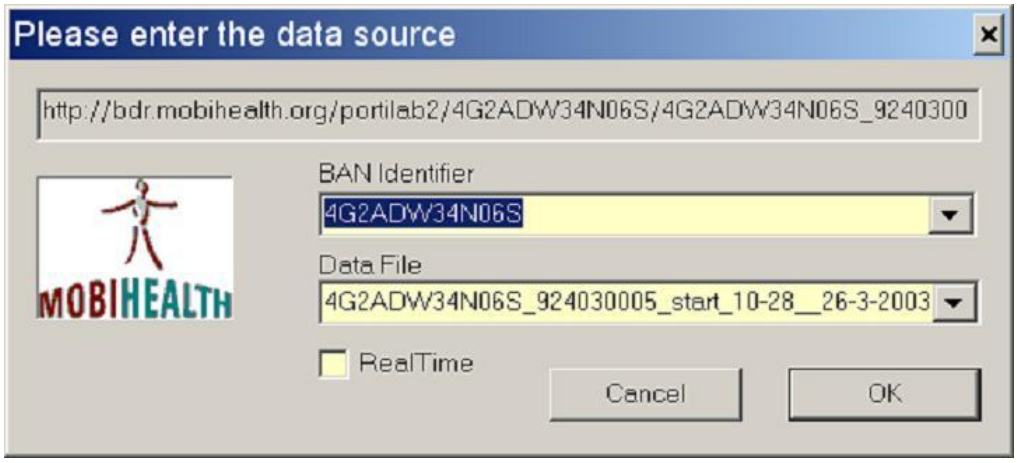



Figure 3.10: MobiHealth info screen

**Realtime / offline measurement**

When viewing the measurement data, we can choose between a realtime and an offline measurement. With realtime the data that is measurement is shown 'live' in PortiLab. With an offline measurement, a file on the BackEnd server can be selected (that was measured in the past).
When selecting RealTime the live data will be shown automatically.

When selecting Offline, all measurement files that are present on the BackEnd server are shown (see figure 3.11).

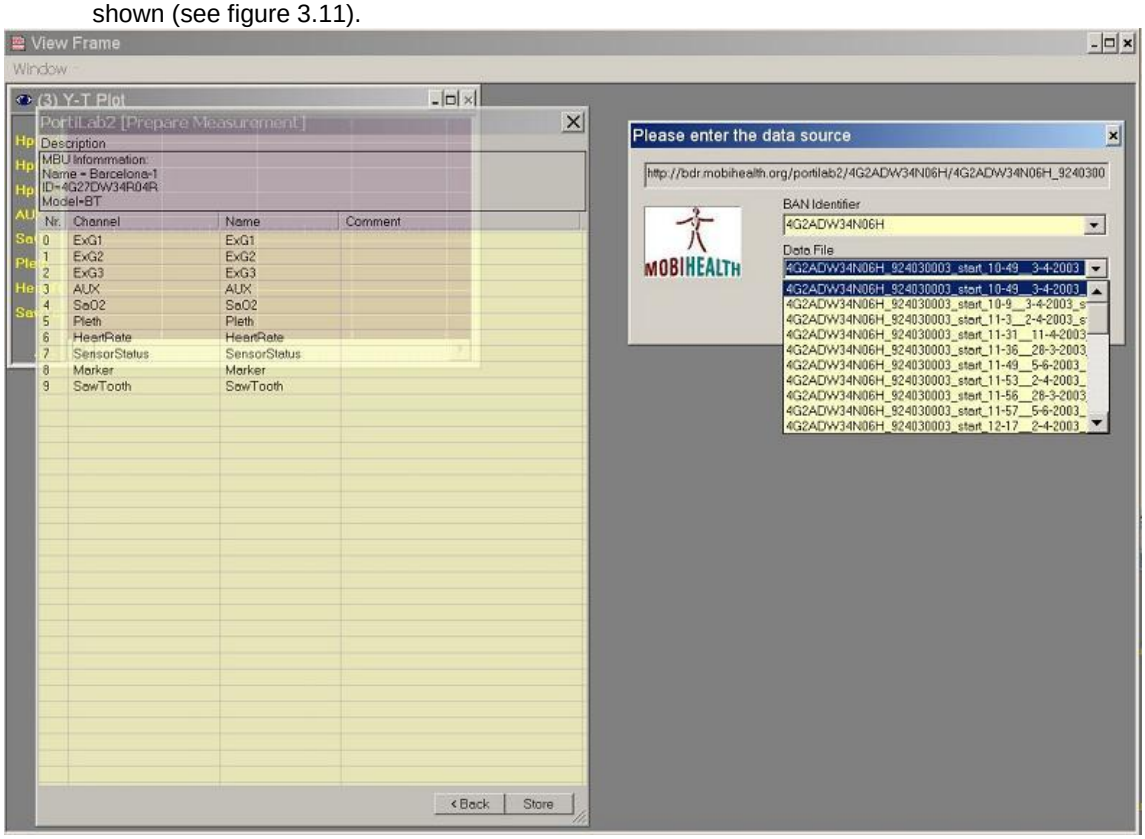



Figure 3.11: MobiHealth offline file selection screen

An example of this measurement is shown in figure 3.12.

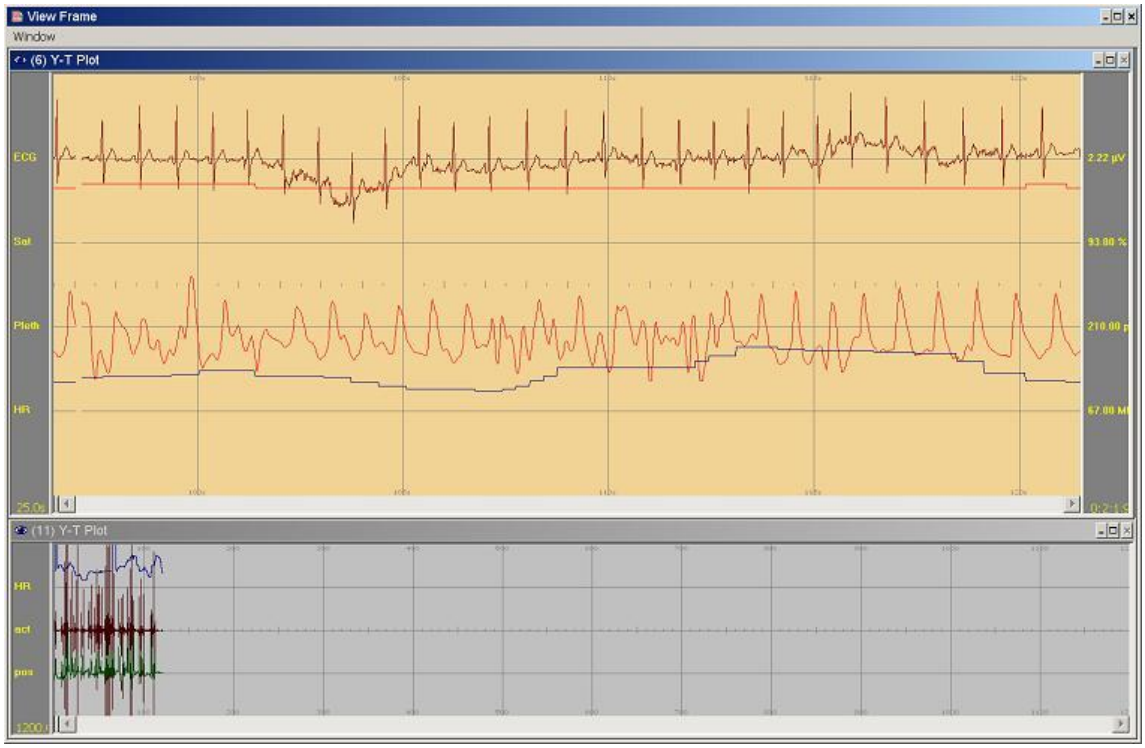


Figure 3.12: measurement example screen

If the measurement has manual input in it, and the configuration file is configured in a way that it can show it, then an extra window will appear which shows the manual input (figure 3.13)

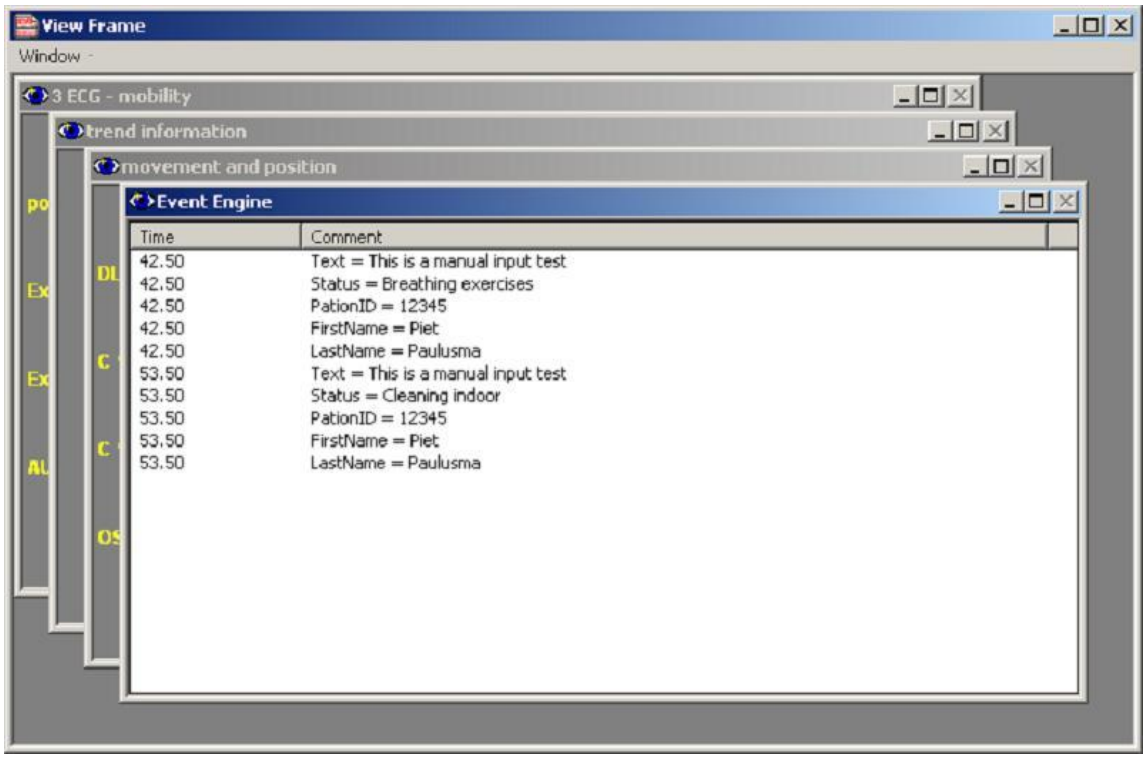



Figure 3.13: measurement with manual input

## 3-3 The review

To show the review of a measurement file double-click the file. Patient-, measurement- and configuration information can be shown via the menu and the dashboard.

After the data file is selected in the MEASUREMENTLIST screen (figure 3.8), an overview screen is shown, which presents all stored data. Via the menu multiple windows can be shown next to each other, and the dashboard can be switched on or off.
Multiple measurement files can be opened (via the menu) to compare data of multiple measurements. Using 'split-screen' it is possible to open the same measurement file multiple times to compare the different intervals of one measurement.
Events and the eventlist can be shown using the dashboard. Jumping trough the eventlist will automatically jump the marker to the correct position.

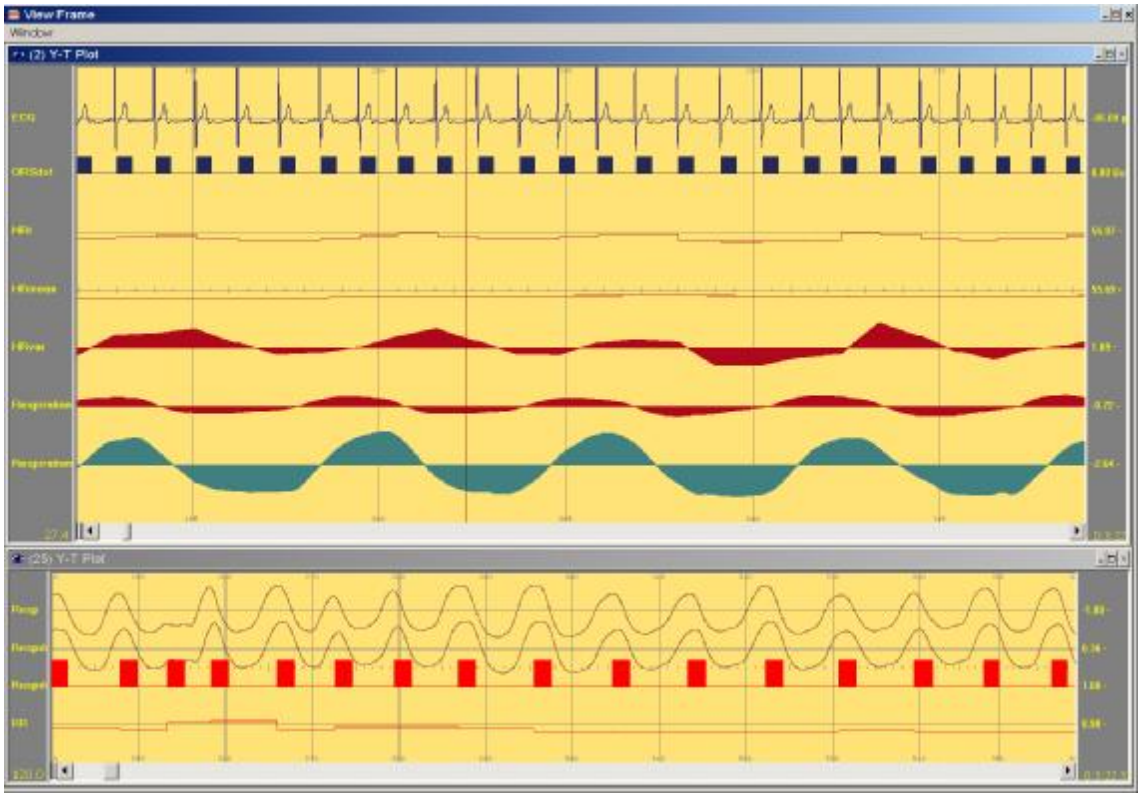


Figure 3.14: The review display

The following functions are available in the review screen:

| **Function** | **Control** |
|---|---|
| Forwards browsing | double arrow in screen |
| Backwards browsing | double arrow in screen |
| Walk-trough signal | arrow keys on keyboard |
| | Marker and mouse |
| | Arrow in screen (forward / backward) |
| Zoom in | |
| Zoom out | |

The following properties can be set (using right mouse button):

- Color:
  - Signal
  - Background
  - Marker
  - Grid
- Scaling en offset:
  - Timebase
  - Grid
- Signal:
  - Line
  - Stars
  - Blocks
  - Filled
  - Numeric indication

- Markers, events and comments can be added to the signal.
- Measuring variables on the screen (using the mouse):
  - Amplitude
  - Amplitude-difference
  - Time-intervals

- Split screen (same file or other file)
- Pop ups:
  - Dashboard
  - Event/comment list
  - Display 1,2,3..n
  - Amplitude bar
  - Numeric indicator
- Action on selected block:
  - Process
  - Analyze
  - Copy
  - Report

## 3-4 Working with PortiLab2: The configuration manager

An overview of all the configuration-files available in Portilab2 will be shown after selecting the 'configuration manager' in the main menu (Figure 3.40). Configuration files can be changed, new configuration files can be created and (existing) configuration files can be imported.

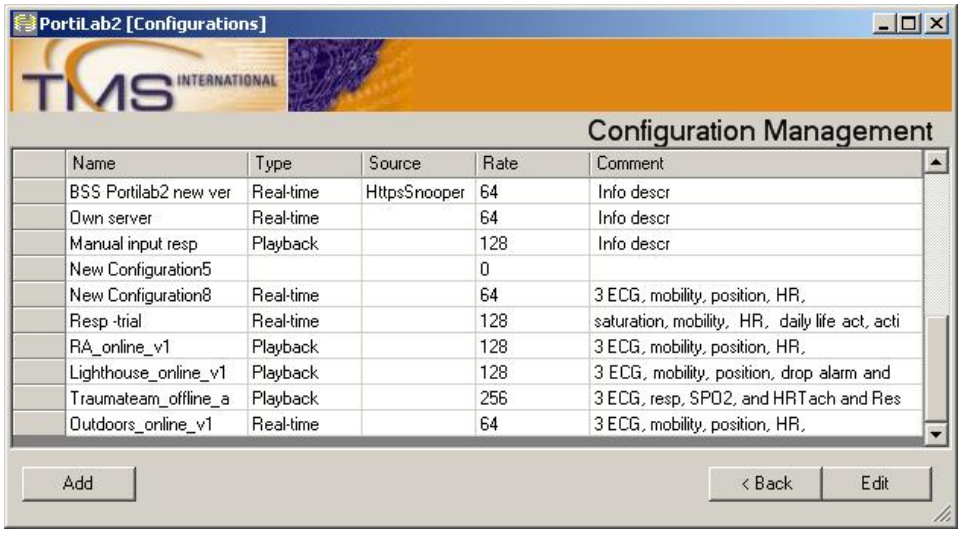



Figure 3.40: Overview of configuration files

**Edit / create configuration file**

*Editing an existing or creating a new configuration file should not be done by the trail owners; therefore this part is not included in the manual. Please contact your MobiHealth support contact if more information is needed about this subject.*

**Importing an existing configuration file**

For the trials there are pre-configured configuration files available, they can be downloaded from the MobiHealth web-site. An existing configuration file has to be imported if you want to use it in Portilab2. This can be done by doing a right mouse click on the list and selecting 'import' (Figure 3.44). The downloaded configuration file can be selected and added to the list by pressing 'open'. Now this configuration file can be edited or used within the 'patient management' part of Portilab2.

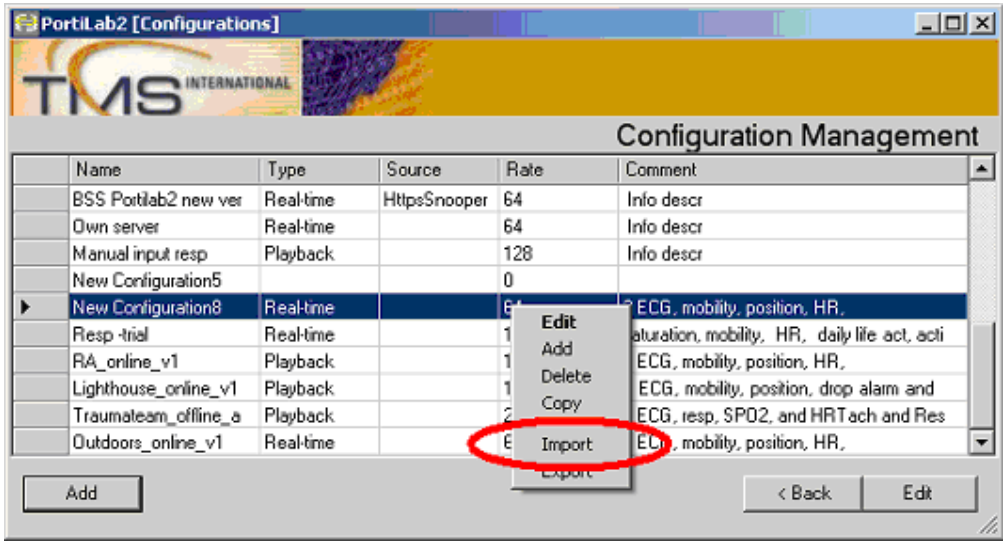



Figure 3.44: Importing an existing configuration file

# 4 GETTING YOUR MobiHealth BAN started (A STEP BY STEP APPROACH)

This chapter describes step by step how to get your MobiHealth BAN (version 3.0) started using GPRS.

## 4.1 Begin situation

- MBU shutdown state, battery fully charged
- Mobi shutdown state, batteries fully charged or new batteries inserted.

*Note: Mobi batteries will last for ~12 hrs (depends on capacity of batteries) of monitoring time.*

## 4.2 Preparation of the patient

Prepare the patient for monitoring (i.e. attach the sensors, connect the wires to the Mobi, etc.)

*Note: Don't start the Mobi yet!*

## 4.3 Start the MobiHealth BAN

1) Press the "reset" button on the bottom of the MBU (i.e. iPAQ) with the stylus for 1 second (see figure 4-1).

2) Wait until the startup screen ("ARM Bootloader" screen) appears and press the blue button on the GPRS sleeve until the LED on the sleeve turns off (takes ~7s) and release the button (see figure 4-2).

Figure 4-1: Resetting the MBU

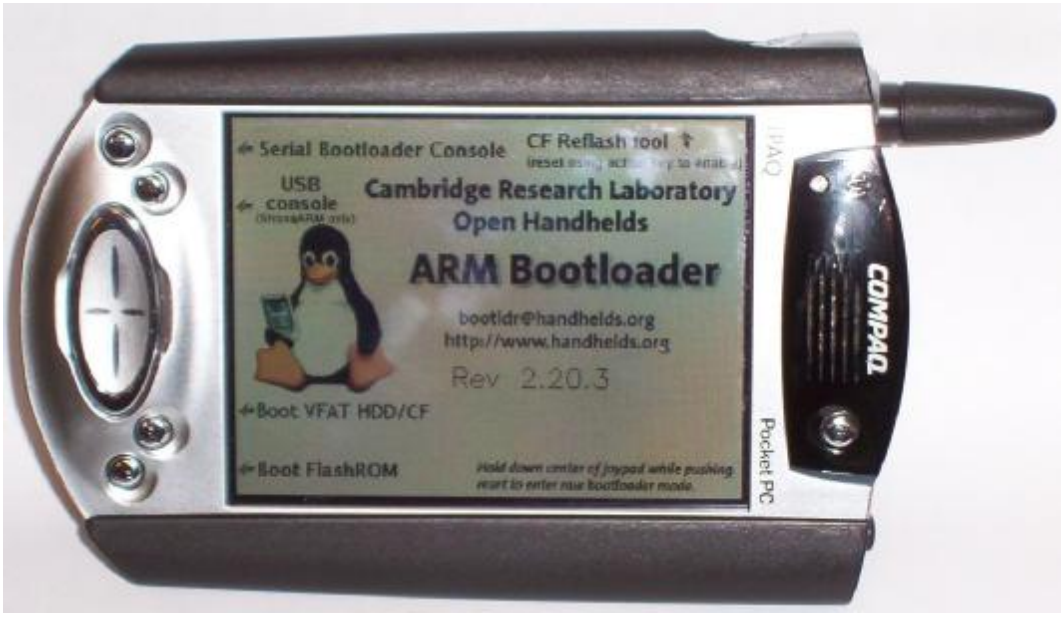



Figure 4-2: Startup screen (ARM Bootloader screen)

******** START TIME CRITICAL PHASE ********
******** YOU HAVE 120 SECONDS TO PERFORM THE NEXT STEPS!!!!!!! ********

3) Login on the MBU.
   The general login information is:
   **Username: root**
   **Password: rootme**
   However for some iPAQs (in particular the Swedish ones) individual user accounts have been created. Users will need to use their own username/password combination to login to the iPAQ.

4) Start the Mobi and check if the LED turns green.

5) Check the GPRS connection by selecting the "Network" icon in the "Settings menu" (wrench icon on top of the screen), and check if an Internet address appears in the "Point to Point (ppp0)" line (see figure 4-3 and figure 4-4).

   If yes, close the "Network Settings" window and continue with step 6.
   If not, close the "Network Settings" window, wait for 2 minutes and repeat step 5.

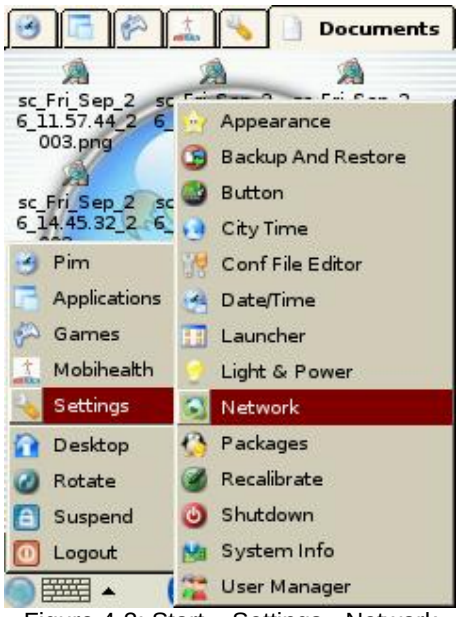



Figure 4-3: Start – Settings - Network

Figure 4-4: Network settings

6) Start the MobiHealth application.

7) Press "Start" button in MobiHealth application screen.

*Note: Application is running if the "Status: MBU activated" or "Status: MBU sending" message appears on the bottom of the MobiHealth screen.*

Note: If the message "Status: MBU Unregistered" appears, EXIT the MobiHealth application and go to step 5.

******** END TIME CRITICAL PHASE ********

*Note: If you don't succeed in activating the MBU, go to step 8.*

8) Stop the MobiHealth application by pressing the "Stop" button.

9) Shutdown the MBU by selecting the "Shutdown" icon in the "Settings menu" (wrench icon on top of the screen), and place the MBU into the cradle (see figure 4-5).

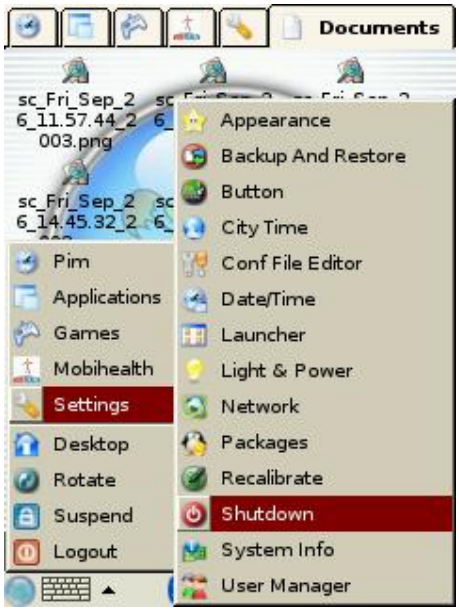



Figure 4-5: Shutdown the MBU.

10) Detach sensors from Mobi and the Mobi will automatically switches off.

******** GO TO BEGIN SITUATION ********

# Glossary

| | |
|---|---|
| BackEnd system | The MobiHealth server that collects all the received sensor data |
| BAN | *Body Area Network*<br>The complete set of MBU, SensorBox and Sensors |
| | |
| Bluetooth | Short range wireless radio technique, used in the MobiHealth trials to communicate between the MBU and the SensorBox |
| GPRS | *General Radio Packet Service*<br>Communication technique for wireless data transport. |
| IPAQ | This is the type of PDA that is used within the MobiHealth trials |
| Jacket | The clipon device that is attached to the PDA, used for the wireless (GPRS) communication |
| MBU | *Mobile Base Unit*<br>The MobiHealth name for the PDA / Handheld |
| PDA | *Personal Digital Assistant*<br>The handheld device used within the MobiHealth trials (type = Compaq iPAQ) |
| PortiLab | The PC application used in the MobiHealth trials to view the sensordata in the hospital |